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EDITORIAL

# Special issue on green photonics

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## EDITORIAL

# Special issue on green photonics

**Guest Editors**

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Photovoltaic (PV) cells can provide virtually unlimited amounts of energy by effectively converting sunlight into clean electrical power. Over the years, significant research and development efforts have been devoted to improving the structural and charge transport properties of the materials used in PV cells. Despite these efforts, the current energy conversion efficiencies of commercial solar cells are still substantially lower than the ultimate limits set by thermodynamics. Economic arguments in addition to the scarcity of some semiconductors and materials used in transparent conductive oxides are also driving us to use less and less material in a cell. For these reasons, it is clear that new approaches need to be found. One possible solution that is more-or-less orthogonal to previous approaches is aimed at managing the photons rather than the electrons or atoms in a cell. This type of photon management is termed *Green Photonics*.

Nano- and micro-photonic trapping techniques are currently gaining significant attention. The use of engineered plasmonic and high refractive index structures shows tremendous potential for enhancing the light absorption per unit volume in semiconductors. Unfortunately, the design space in terms of the nanostructure sizes, shapes, and array structures is too large to allow for optimization of PV cells using brute force simulations. For this reason, new intuitive models and rapid optimization techniques for advanced light trapping technologies need to be developed. At the same time we need to come up with new, inexpensive, and scalable nanostructure fabrication and optical characterization techniques in order to realize the dream of inexpensive, high power conversion efficiency cells that make economic sense. This special issue discusses some of the exciting new approaches to light trapping that leverage the most recent advances in the field of nanophotonics. It also provides some insights into why giving the green light to green photonics may help play a role in resolving the pending energy crisis.The papers included in this 'green photonics' special issue demonstrate current global activity, involving a wide range of distinguished authors.

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